FLORISTICS OF BAYGALLS IN CENTRAL LOUISIANA

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ABSTRACT

Headwater plant communities --- baygalls and pitcher plant bogs --- were studied in the northern part of the Winn Ranger District, Kisatchie National Forest, Louisiana. Floristically baygalls, discussed in this paper, form a fairly uniform community type across most of the West Gulf Coastal Plain.

KEY WORDS: baygall, West Gulf Coastal Plain, floristics, Kisatchie National Forest, Louisiana.

INTRODUCTION

Baygalls are a characteristic wetland community of the Atlantic and Gulf Coastal Plains extending through western Louisiana into eastern Texas (Allen et al. 1988; Bridges and Orzell 1989; Brooks et al. 1993; Christenson 1988; Harcombe et al. 1993; Nesom et al. 1997; Weakley et al. 1998). They are variable over their range but are generally characterized by such woody species as *Magnolia virginiana* (sweet bay) and *Ilex coriacea* (gallberry holly), for which the community is named. Other common associates are *Acer rubrum, Ilex opaca, Nyssa biflora, Persea palustris, Rhododendron* spp., and

Vaccinium spp. In western Louisiana and eastern Texas, baygalls are generally headwater communities occurring at streamheads or on short slopes that receive enough seepage to be permanently saturated. They are recognized as a natural community in both Louisiana and Texas (Diamond et al. 1987; Louisiana Natural Heritage Program 1994; Texas Natural Heritage Program 1993; Turner et al. 1999; Weakley et al. 1998; Van Kley 1999*a,b*) and have been described for various localities in the West Gulf Coastal Plain (Ajilvsgi 1979; Brooks et al. 1993; Marks and Harcombe 1981; Martin and Smith 1991; Nesom et al. 1997; Nixon et al. 1980, 1983; Nixon and Ward 1988; Orzell 1990; Van Kley 1999*a,b*; Watson 1979).

As with most plant communities, descriptions usually center on woody species because they can be identified year round and are relatively easily quantified. The herbaceous layer is often briefly mentioned but seldom described in detail. In this study we describe both.

SITE DESCRIPTION

This study was conducted on the northern part of the Winn Ranger District, Kisatchie National Forest, in northern Natchitoches and Winn parishes, Louisiana. All study sites are located within what is generally classified as riparian forest habitat that is adjacent to, and often surrounded by, upland longleaf pine forest (Martin and Smith 1991). The area was originally dominated by longleaf pine (Eldredge 1934; Martin and Smith 1991), notably in forest/savanna form on uplands, but today in some areas the longleaf pine has been replaced with off-site species such as loblolly pine. The longleaf pine forest community type has received detailed ecological and distributional attention in the West Gulf Coastal Plain (Bridges and Orzell 1989; Evans 1997; Frost 1993; Harcombe et al. 1993; Van Kley 1999*a,b*).

The area has a subtropical humid climate with hot summers and mild winters. The average annual precipitation is about 140 cm spread evenly throughout the year. The average annual temperature is about

20C (extreme range is about -7C to 38C). Thunderstorms average about 60 days per year and are concentrated in the growing season (Olson and Platt 1995). Fire was an important element in the evolution of the plants and animals of the area, many communities being dependent on growing season burns ignited by lightning strikes (Bridges and Orzell 1989; Drewa et al. 2002; Frost 1998; Harcombe et al. 1993; Olson and Platt 1995; Platt 1999).

Baygalls are situated on loamy fine sand, fine sandy loam, or fine loamy sand (Malbis, Betis, Ruston, Sacul). All are below uplands (ridgetops) of similar soils but with gentler gradients (1-5 percent as opposed to 5-12 percent). All are Paleudults and Hapludults (suborder = Udults, Order = Ultisols) (Martin et al. 1990). There is little topographic relief except for slightly rolling hills. The study area is on the older geologic surfaces, notably the Sparta formation of Tertiary age (Groat and Roland 1984).

The study area in general consists of two north-south ridges divided by Saline Bayou. The watershed of the western area flows into Black Lake Bayou to the west and the Saline Bayou to the east. The watershed of the eastern ridge flows into Saline Bayou to the west and Dugdemona River to the east. All ultimately discharge into the Red River.

METHODS

1. We made monthly visits to each of six baygalls (numbers 5 through 10) between March and November 1999 to obtain complete floristic lists for each site. The study sites are listed in Appendix 1 by name and number. All sites were between 0.1 and 0.2 ha in size. Voucher collections for many of the species are deposited at BRIT and LSU. Plant nomenclature follows Kartesz and Meacham (1999); scientific authorities for all names used in this paper can be read from that reference.

Species	Number of Individuals	Mean Diameter (cm)	Range (cm)
Magnolia virgin.	32	10.5	2-30
Nyssa biflora	30	8.0	2-40
Persea palustris	29	3.5	2-10
Viburnum nudum	9	2.0	2
Acer rubrum	7	6.1	2-10
Ilex opaca	5	2.4	2-3
Chionanthus virg.	4	4.0	2-10
Vaccinium sp.	4	2.3	2-3
Liquidambar styra.	4	4.0	2-6
Toxicodendron v.	3	2.7	2-4
Taxodium distich.	3	13.7	12-17
Pinus taeda	1	12.0	12
Alnus serrulata	1	2.0	2
Quercus alba	1	18.0	18

Table 1. Dominant woody species.

2. In May and June 1999 we established ten, 5 X 5 meter quadrats (25 m sq.), one in each of ten baygalls; we added four sites to the original six to increase our sample size. Frequency and diameter of all woody species with a dbh of 2 cm or greater were recorded. Herbaceous species presence was described by identifying all species in the plots; herbaceous cover was measured and percent cover estimated for major species. Canopy cover was estimated for the quadrat.

3. A soil sample was collected from the upper 15 cm of each of the ten 5 X 5 meter plots and analyzed by A & L Laboratories, Memphis, Tennessee.

RESULTS

Appendix 2 summarizes the total species composition of six

Species	Percent by plot									
	1	2	3	4	5	6	7	8	9	10
Athyrium filix-fem.						6				
Bignonia capreolata						1				
Carex atlantica								19		
Carex debilis			15	4	6	10			2	
Carex leptalea	21		2			2		18	3	10
Chasmanthum laxum			1							2
Dichanthelium dich.							1	1		
Dichanthelium sp.										4
Eleocharis tortilis					2		2	5		10
Gelsemium semper.								1		
Liverworts	2						2	3	1	3
Lycopus rubellus							1			
Mitchella repens	2	1	1	30		4		2	1	
Osmunda cinnam.	1	1	5	2	4	7		5	4	
Osmunda regalis	1	1	1			2			5	
Platanthera clav.										1
Rudbeckia scabrifolia						4				
Scleria sp.		1								
Scleria triglomerata							1			
Solidago patula						3	2		1	
Sphagnum sp.				10						
Viola primulifolia	2		1							
Woodwardia areolata	22	1	30	20	88	50	50	30	60	
Woodwardia virginica									3	20
Xyris laxifolia								1		
Total	50	5	52	69	98	82	70	80	81	54

Table 2. Percent herbaceous ground cover by plot.

baygalls. Appendix 3 shows occurrence by plot for each species in the 5 X 5 m plots. Table 1 summarizes the larger woody vegetation in ten 5 X 5 m plots. Table 2 gives the percent of herbaceous ground cover by dominant species in each plot. Only species accounting for 1% or more

in any plot are included. Table 3 gives percentage frequency of all species from the baygalls as rated in Reed's (1988 and update) hydrophytic classification. It also gives the prevalence index for the entire sample (see Cowardin et al. 1979; Federal Manual 1989; MacRoberts and MacRoberts 2001; Reed 1988; U.S. Corps of Engineers 1987 for an explanation of terms and measures). Table 4 gives information on soil samples from the ten sample sites.

DISCUSSION

There were 40 families, 61 genera, and 89 species in the six baygalls. The average baygall had 52 species (range 39 to 68). Dicots accounted for 54 percent of the total species. All sites had liverworts and *Sphagnum*, which are not included in the totals. Sorenson's Index of Similarity among the six baygalls ranges from 62 to 87, indicating that they are all floristically the same community.

Magnolia virginiana, *Nyssa biflora*, and *Persea palustris* were clearly the dominant woody species, both in number of individuals and in basal area within the 5 X 5 m plots. Several species, for example, *Smilax laurifolia*, were present in many plots, but since the stems were always less than 2 cm diameter, they are not listed among those in Table 1. Canopy cover of the ten plots ranged from 80% to 100% and averaged 94%.

Overall herbaceous cover ranged from 5% to 98% and averaged 65%. Ferns and monocots dominated. The following species are listed in order of dominance in the herbaceous layer: *Woodwardia areolata* (35.1%), *Carex leptalea* (5.6%), *Mitchella repens* (4.1%), *Carex debilis* (3.7%), *Osmunda cinnamomea* (2.9%), *Woodwardia virginica* (2.3%), *Carex atlantica* (1.9%), *Eleocharis tortilis* (1.9%), liverworts (1.1%), *Osmunda regalis* (1.0%), *Sphagnum* sp. (1.0%). All the other species in these plots accounted for less than 1% each of the total herbaceous layer.

	OBL	FACW	FAC	FACU	UPL	Prev. Index	Sample Size
All species	27	39	24	10	0	2.17	89
Woody species	9	38	35	18	0	2.62	34
Herb. species	38	40	16	6	0	1.89	55

Table 3. Species percents by wetland categories, prevalence index, and species sample size (see text for category explanation).

The flora of these baygall sites is clearly dominated by hydrophytes. About 80% are OBL, FACW, and FAC (50% or higher qualifies a site as wetland). Counting all species for these sites, the prevalence index is 2.17, meaning that baygalls are wetlands (1.0 means that all species are obligate wetland species, 5.0 means that all species are obligate upland [dry] species). Woody and non-woody species differed in prevalence: the prevalence index for woody species was 2.62 and that for herbaceous species was 1.89. This suggests either that woody vegetation has a greater moisture gradient than non-woody species or that the species are somewhat misclassified.

The soils are acidic and low in nutrients and organic matter, falling within the normal range of soil chemistry of baygalls and pitcher plant bogs in east Texas and west Louisiana except that the pH for the present group of baygalls is slightly lower (MacRoberts and MacRoberts 2001; MacRoberts et al. 2002; Nesom et al. 1997; Nixon and Ward 1986).

The West Gulf Coastal Plain is ecologically part of the eastern flora. Using Kartesz and Meacham (1999), we determined the distribution of the species that occur in our study sites. We found 95% to be eastern, 3% cosmopolitan (found throughout North America), and 2% endemic. The endemics are *Rudbeckia scabrifolia* and *Rhododendron oblongifolium*. The cosmopolitan species are *Carex leptalea*, *Juncus effusus*, and *Athyrium filix-femina*.

Site	Exchangeable ions (ppm)					
	pH	P	K	Ca	Mg	OM%
1	4.5	11	32	322	46	1.9
2	4.3	10	51	458	69	3.3
3	4.4	10	28	196	52	3.1
4	3.7	13	62	58	41	4.8
5	4.1	4	30	147	36	1.9
6	4.1	6	22	78	25	2.2
7	4.6	15	19	1136	36	1.8
8	4.1	2	16	103	31	2.3
9	4.3	8	25	86	28	2.8
10	4.0	11	33	135	69	4.4

Table 4. Soil chemistry.

Baygalls in the West Gulf Coastal Plain occur in association with pyrogenic communities (Bridges and Orzell 1989; Harcombe et al. 1993). But unlike these communities, baygalls are not pyrogenic. We have witnessed in many instances that prescribed fire, both in growing and non-growing season, does not penetrate far, if at all, into baygall communities but at most fingers into the edges. These fires, which historically probably occurred once every few years and which probably occurred in the growing season and were caused by lightning, cleared the surrounding lands but usually left these baygall "islands" intact.

Comparing baygalls with other plant communities in the West Gulf Coastal Plain indicates that, while distinct, they are most closely related to pitcher plant bogs as indicated by ordination (Van Kley 1999*a*) and direct species comparisons (MacRoberts and MacRoberts 2001; Nixon and Ward 1986). For example, comparing the total floristic list for six baygalls to four small pitcher plant bogs on the Kisatchie District of the Kisatchie National Forest with comparable species numbers gives an Index of Similarity (Sorenson's) in the mid-30s (MacRoberts and

MacRoberts 2001). Thus, while sharing many species, baygalls and bogs do not share enough to be considered the same plant community.

Martin and Smith (1991) have distinguished between "wooded seeps" and "bayhead swamps" but little in their description separates these entities; these authors admit that the two communities are very similar and intergrade. Brooks et al. (1993) found that wooded seeps graded into wet creek bottoms or bayhead swamps. On the basis of quantitative data, Van Kley (1999*a*) and Turner et al. (1999) found that these "different" communities were clearly one. Our work supports the conclusion that they be considered the same.

This does not mean that baygalls are uniform. Most of our baygalls are the same community type described by Nixon et al. (1983) as "wet," which occurs at branch heads, creek heads, wet creek bottoms, and seepages. However, some show similarities to bogs (Nixon and Ward 1988). Notable is site 10, which showed bog similarities and may have been a bog at one time.

While we found *Nyssa biflora* and *Viburnum nudum* important, Nixon et al. (1980) and Nixon and Ward (1988) in their study of wet creek bottoms in Nacogdoches County and in the Trout Creek drains on the Angelina National Forest in Texas did not. As they point out, at least in their Trout Creek location, the herbaceous species are a mixture of baygall and seepage bog species, which may partly explain the difference (Nixon and Ward 1986). In the Trout Creek area, baygalls and bogs are often contiguous and the species from one grade into the other in ecotonal zones.

Brooks et al. (1993) studied baygalls on a north-south gradient in east Texas from southern Rusk to central Hardin counties. They found that, while *Nyssa biflora* and *Magnolia virginiana* were important in both northern and southern examples, *Acer rubrum*, *Liquidambar styraciflua*, and *Morella carolinensis* were important in the north and *Cyrilla racemiflora*, *Ilex coriacea*, and *Quercus laurifolia* were important in the south. They also found that *Persea palustris* (which

was important in the Winn District baygalls) was not paticularly important in either group.

Nixon et al. (1983) in their study of different segments of a single streamside in San Augustine County found that different areas of the stream had different species composition, depending on moisture.

Nesom et al. (1997) found that in Walker and Anderson counties on the western edge of the baygall community range, such trees as *Magnolia* and *Persea* have entirely dropped out of the flora and such species as *Viburnum nudum* dominate.

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Appendix 1. Site numbers, locations, and common names. All sites are on the Winn Ranger District, Kisatchie National Forest.

1) Strange Road Baygall. Natchitoches Parish, Compartment 18. T12NR6WS1/12.
2) Lewis Klein Baygall. Natchitoches Parish, Compartment 18. T13NR6WS35/36.
3) Thalictrum Baygall. Natchitoches Parish, Compartment 18. T13NR6WS25/26/35/36.
4) Road 506 Baygall. Winn Parish, Compartment 5. T13NR5WS9.
5) Compartment 18 Baygall. Natchitoches Parish, Compartment 18. T13NR6WS26.
6) Compartment 19 Baygall. Natchitoches Parish, Compartment 19. T13NR6WS25.
7) Rudbeckia Baygall. Natchitoches Parish, Compartment 1. T13NR7WS2.
8) Snake Baygall. Natchitoches Parish, Compartment 1. T13NR6WS7.
9) Cypress Branch Baygall. Winn Parish, Compartment 5. T13NR5WS8/9.
10) Road W5A Baygall. Winn Parish, Compartment 5. T13NR5WS4.

Appendix 2. Vascular plants occurring in six baygalls (x = present, -=absent)

FAMILY/ SPECIES	SITE					
	5	6	7	8	9	10
ACERACEAE						
Acer rubrum	x	x	x	x	x	x
ANACARDIACEAE						
Toxicodendron vernix	x	x	x	x	x	x
APIACEAE						
Oxypolis rigidior	x	-	-	-	x	x
Ptilimnium capillaceum	-	-	-	-	-	x
AQUIFOLIACEAE						
Ilex opaca	x	x	x	x	x	x
I. vomitoria	x	x	-	x	x	x
ARACEAE						
Arisaema triphyllum	x	x	-	-	-	x
ASTERACEAE						
Doellingeria sericocarpoides	-	-	-	-	x	x
Elephantopus nudatus	-	-	-	-	x	-
Eu patorium perfoliatum	x	x	x	x	-	x
E. rotundifolium	-	x	x	-	x	x
Helianthus angustifolius	-	-	-	-	-	x
Liatris pycnostachya	-	-	-	-	-	x
Rudbeckia scabrifolia	-	-	x	-	-	-
Solidago patula var. strictula	x	x	x	-	x	x
S. rugosa var. aspera	-	-	-	-	-	x
Symphyotrichum lateriflorum	x	x	-	x	x	x
BETULACEAE						
Alnus serrulata	x	x	-	x	x	-
BIGNONIACEAE						
Bignonia capreolata	x	x	-	-	x	x

FAMILY/ SPECIES	SITE					
	5	6	7	8	9	10
BLECHNACEAE						
Woodwardia areolata	x	x	x	x	x	x
W. virginiana	x	-	x	-	x	x
CAPRIFOLIACEAE						
Viburnum nudum	x	x	x	x	x	x
CLUSIACEAE						
Hypericum crux-andreae	-	-	-	x	-	-
CORNACEAE						
Cornus florida	-	x	-	-	-	-
Nyssa biflora	x	x	x	x	x	x
CUPRESSACEAE						
Taxodium distichum	-	-	-	x	-	-
CYPERACEAE						
Carex atlantica	x	x	-	x	x	x
C. crebriflora	-	-	-	-	x	x
C. crinata	x	-	-	-	-	x
C. debilis	x	x	-	x	x	x
C. glaucescens	x	x	x	x	-	x
C. intumescens	x	-	-	-	-	-
C. leptalea	x	x	-	x	x	x
C. lurida	x	x	-	-	-	-
Eleocharis tortilis	x	-	x	x	-	x
E. tuberculosa	-	-	x	-	-	-
Rhynchospora caduca	x	-	-	-	-	-
R. glomerata	x	x	x	x	-	x
R. gracilenta	-	-	x	x	x	x
Scleria oligantha	-	-	x	x	-	x
S. triglomerata	x	x	x	-	-	x
DRYOPTERIDACEAE						
Athyrium filix-femina	x	x	-	x	x	x
ERICACEAE						
Rhododendron canescens	x	x	x	x	x	x
R. oblongifolium	x	x	x	-	-	-

FAMILY/ SPECIES	SITE					
	5	6	7	8	9	10
Vaccinium fuscatum	x	x	x	x	x	x
V. corymbosum	x	x	-	-	-	x
ERIOCAULACEAE						
Eriocaulon decangulare		-		-	-	x
FAGACEAE						
Fagus grandifolia	-	x	-	-	-	
Quercus alba	x	x	-	x	x	
Q. nigra	-	-	-	-	-	x
GENTIANACEAE						
Bartonia paniculata			x	-	-	-
HAMAMELIDACEAE						
Liquidambar styraciflua	x	x	x	x	x	x
IRIDACEAE						
Sisyrinchium mucronatum		x	-	-	-	-
JUNCACEAE						
Juncus effusus	x	x	-	-		
LAMIACEAE						
Lycopus rubellus	x	x	x	x	x	x
LAURACEAE						
Persea palustris	x	x	x	x	x	x
LILIACEAE						
Melanthium virginicum	x	x	-	-	x	x
LOGANIACEAE						
Gelsemium sempervirens	x	x	-	x	x	x
MAGNOLIACEAE						
Magnolia virginiana	x	x	x	x	x	x
MELASTOMATACEAE						
Rhexia mariana	-	-	-	-	-	x
R. petiolata	-	-	-	-	-	x
MYRICACEAE						
Morella cerifera	-	x	x	-	-	x
M. carolinensis	x	x	x	x	x	x
OLEACEAE						

FAMILY/ SPECIES	SITE					
	5	6	7	8	9	10
Chionanthus virginicus	x	-	-	-	-	x
ORCHIDACEAE						
Calopogon tuberosus	-	-	-	-	-	x
Platanthera ciliaris	-	-	-	-	-	x
P. clavellata	x	x	x	x	-	x
Pogonia ophioglossoides	-	-	-	-	-	x
OSMUNDACEAE						
Osmunda cinnamomea	x	x	x	x	x	x
O. regalis	x	x	x	x	x	x
PINACEAE						
Pinus palustris	-	x	-	x	x	x
P. taeda	x	x	-	x	x	x
POACEAE						
Chasmanthium laxum	x	x	x	x	x	x
Dichanthelium commutatum	x	x	-	-	x	x
D. dichotomum var. *dichotomum*	x	x	x	x	x	x
Leersia virginica	x	-	-	-	-	-
Panicum verrucosum	-	-	-	-	x	-
Saccharum giganteum	-	-	-	-	-	x
ROSACEAE						
Photinia pyrifolia	-	x	x	-	x	x
RUBIACEAE						
Mitchella repens	x	x	-	x	x	x
SMILACACEAE						
Smilax bona-nox	x	x	-	-	-	-
S. glauca	x	x	-	-	-	x
S. laurifolia	x	x	x	x	x	x
S. rotundifolia	-	-	-	x	-	-
VERBENACEAE						
Callicarpa americana	x	x	x	x	x	x
VIOLACEAE						
Viola primulifolia	x	x	x	x	x	x

FAMILY/ SPECIES	SITE					
	5	6	7	8	9	10
VITACEAE						
Vitis rotundifolium	x	x	x	x	x	x
XYRIDACEAE						
Xyris ambigua	-	-	-	-	x	x
X. laxifolia	-	-	x	x		
Sphagnum	x	x	x	x	x	x
Liverworts	x	x	x	x	x	x

Appendix 3. Species/plot occurrence.

Species	Occurrence by Plot									
	1	2	3	4	5	6	7	8	9	10
Vaccinium sp.	x	x	x	x	x	x	x	x	x	x
Woodwardia areolata	x	x	x	x	x	x	x	x	x	
Magnolia virginiana		x	x	x	x		x	x	x	x
Osmunda cinnamomea		x	x	x	x	x	x		x	x
Persea palustis		x		x	x	x	x	x	x	x
Michella repens	x	x	x	x		x		x	x	
Nyssa biflora	x	x		x	x			x	x	x
Carex leptalea	x		x			x		x	x	x
Liquidambar styr.			x		x	x	x	x	x	
Viburnum nudum	x	x	x			x		x		x
Carex debilis			x	x	x	x			x	
Ilex opaca	x	x	x	x				x		
Liverworts	x						x	x	x	x
Morella carolinensis			x	x			x	x		x
Osmunda regalis	x	x	x			x			x	
Acer rubrum		x	x					x	x	
Dichanthelium sp.							x	x	x	x
Eleocharis tortilis					x		x	x		x
Lycopus rubellus	x		x				x		x	
Smilax laurifolia	x	x	x							x
Rhododendron sp.		x					x			x
Solidago patula						x	x		x	
Callicarpa americana					x	x				
Athyrium filix-fem.		x				x				
Chasmanthium laxum			x							x
Chionanthus virgin.			x	x						
Ilex vomitoria						x			x	
Morella cerifera	x	x								
Pinus taeda	x				x					
Toxicodendron vernix		x								x
Scleria sp.		x					x			

Appendix 3. Species/plot occurrence (cont.).

Species	Occurrence by Plot									
	1	2	3	4	5	6	7	8	9	10
Woodwardia virginica									x	x
Viola primulifolia	x		x							
Alnus serrulata		x								
Photinia pyrifolia						x				
Bignonia capreolata						x				
Carex atlantica								x		
Eupatorium rotund.									x	
Gelsemium semper.								x		
Platanthera clave.										x
Quercus alba						x				
Rhynchospora caduca			x							
Rudbeckia scabrif.							x			
Sphagnum sp.				x						
Taxodium distichum								x		
Vitis rotundifolia			x							
Xyris laxifolia								x		